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ABSTRACT

This study determines the factor structure of motor performance in children attending kindergarten and first and second grades. Forty-three tests of physical size and fine and gross motor skills were administered to a stratified random sample of children who attended the public schools of Battle Creek, Michigan in 1969. The sample involved 100 boys and girls, respectively, at each of the three grades (total N=600). Intercorrelations of the test items were determined by grade and sex, and the intercorrelation matrices were subjected to factor analysis. The principal components solutions were extracted and rotated according to the Varimax Criterion proposed by Kaiser. Differences in the factor structures were noted between sexes and grade levels. In general, the factors that accounted for most of the total variance across the three grades were body structure (height and breadth), body size (girths and skinfolds), gross hand-eye coordination, fine hand-eye coordination, static balance, dynamic balance, grip strength, coordination of gross movements, and ocular coordination. A 19-item bibliography is included, and statistics regarding body size, body structure, hand-eye coordination, gross motor coordination, dynamic balance, static balance, ocular coordination, grip strength, rating of aggression, and social development are appended. (Author)

ED 098154

FACTOR ANALYSES OF MOTOR PERFORMANCE FOR KINDERGARTEN, FIRST AND SECOND GRADE CHILDREN: A TENTATIVE SOLUTION

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Structural determination of the motor domain has been confined primarily to individuals who were beyond the developmental stages in skill acquisition. Of the sixty plus studies reviewed by us, only eighteen were pertinent to this investigation in terms of the age level of the subjects and the battery of tests employed. Reports on the factor structure of motor skills in early and middle childhood are rare and provide equivocal answers because test batteries are generally incomplete and investigators have failed to extract all of the useful information from their data. Liba and Safrit (1969) recommended that in the process of factoring data, at least two of the four acknowledged initial factoring methods should be utilized; namely, canonical and alpha factor analyses and principal components and image analysis. All of the published reports reviewed by us failed to meet this criterion of analysis, and it should be noted that this report is also limited to the principal components solution.

Methodology

This report is the result of a procedure to assess the motor status of kindergarten, first and second grade children of the Battle Creek, Michigan, schools. Subjects included a random sample of 100 boys and girls, respectively from each of the three grades, stratified according to geographical location and socioeconomic level within the school system. An exact account of the subjects by grade and sex is provided in Table I.

TABLE I

DISTRIBUTION OF SUBJECTS BY GRADE LEVEL AND SEX

Grade	Boys	Girls	Total
Kindergarten	91	96	187
First	99	94	193
Second	103	93	196
Total	293	283	576

The hypothesized factor structure, presented in Table II, departs slightly from the conventional batteries reported for older subjects, in that it allocates more items to the control of movement, in lieu of items designed to assess the production of force. It was hypothesized that components which are commonly identified as power, strength, agility and endurance would not be as discrete when their representative tests were applied to young children. This speculation is

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confirmed by our results, although it is possible that the addition of test items would have produced some of the conventional factors listed above.

The emphasis on visual perception as a component of motor skill acquisition is reflected by the inclusion of several items to measure ocular coordination per se, as well as those tasks which require eye-hand coordination in vigorous and subdued movements. The relationship of motor skills to social development is an area of concern to many educators. Because the assessments of social development were part of the initial test battery, they were included in this report.

A total of 51 tests were administered to the sample during the months of April and May of 1969. Data on each of the six grade-by-sex groups were analyzed separately. Principal components solutions were extracted from the intercorrelation matrices and rotated according to the varimax criterion proposed by Kaiser (1958). The varimax rotation of all factors with eigenvalues greater than 1.00 resulted in from nine to eleven factors per group, accounting for between 88 and 98 percent of the total variance.

Results

The resulting factors are presented in summary form in Table III. The primary discrepancies between the hypothesized and the extracted factors were as follows: "grip strength" was present as a discrete factor in all groups; "static balance" and "dynamic balance" emerged as separate factors in all groups, excluding the second grade boys; the "body size" and "body structure" of kindergarten boys and girls and first and second grade girls were combined into one factor for first and second grade boys; and "teacher's ratings of verbal and physical aggression" emerged as a factor distinct from its hypothesized place within the category of "social development".

Each of the factors is discussed in terms of the variables which consistently loaded within a specific category. A detailed account of the factor loadings, by grade and sex, is provided in Appendix A.

Factor: Body Size - This factor was the first rotated factor to emerge within each group and accounted for between 13 to 27 percent of the variance. It was characterized by high loadings in weight, girths and skinfolds. In five of six groups the variables included: weight (.56 to .93), biceps girth (.64 to .87), subscapular skinfold (.60 to .77), calf girth (.47 to .86), ponderal index (-.54 to -.84), thigh girth (.54 to .89), umbilical skinfold (.66 to .80) and biacromial diameter (.30 to .80). This factor resembles others identified as "cross-sectional" by Marshall (1936), "alpha" by Mullen (1940), "growth in fat" by McCloy (1940), "ponderosity" by Barry and Cureton (1961), "body bulk" by Burt (1962), and "body-bulk physique" by Phillips (1968).

Factor: Body Structure - This factor was consistently associated with the variables of skeletal lengths and breadths and skeletal age. It appeared as a separate factor in kindergarten boys and girls and first and second grade girls. In first and second grade boys the variables of length and breadth were combined with those of body size. Variables which loaded highly under body structure were standing height (.76 to .91), sitting height (.58 to .79), skeletal age (.47 to .80), biacromial diameter (.46 to .75), weight (.29 to .71), and bicristal diameter (.32 to .66).

VARIABLES INCLUDED IN THE HYPOTHESIZED FACTOR STRUCTURE

Body Structure

Standing Height
Sitting Height
Biacromial Diameter
Biiliac Diameter
Skeletal Age

Body Size

Weight
Shape Index
Ponderal Index
Triceps Skinfold
Subscapular Skinfold
Umbilicus Skinfold
Biceps Girth
Thigh Girth
Calf Girth
Chronological Age

Gross Body Coordination

10 Yd. Shuttle Run
30 Yd. Dash
Standing Broad Jump
Hopping - Right Foot
Hopping - Left Foot
Skipping
Jumping Jacks
Angels in the Snow
Pulse-Rate Recovery Test
400 Ft. Shuttle Run
Sit-and-Reach
Grip Strength - Right
Grip Strength - Left

Eye-Hand Coordination - Gross

Bounce and Catch-Right - Numerical
Bounce and Catch-Right - Qualitative
Bounce and Catch-Left - Numerical
Bounce and Catch-Left - Qualitative

Eye-Hand Coordination - Fine

Reaction Time
Goodenough Draw-A-Man
Benton Visual Retention (10 subtests)

Ocular Coordination

Ocular Pursuits I
Ocular Pursuits II
Ocular Pursuits III

Social Development

Self Concept Score
Social Maturity Score
Social Maturity Quotient
General Anxiety Score
Teacher's Rating of Anxiety
Teacher's Rating - Physical Aggression
Teacher's Rating - Verbal Aggression
Palmer Sweat Test

Balance

Rail Balance - Right
Rail Balance - Left
Dynamic Balance - Numerical
Dynamic Balance - Qualitative
Cross-Over Steps

The factor identified here as body structure is similar to one called "linear factor" by Marshall (1931), "beta" by Mullen (1940), "general growth" by McCloy (1940), "lankiness" by Barry and Cureton (1961), "linearity of bone structure" by Burt (1962), "height" by Willee (1964), and "body linearity" by Phillips (1968).

Numerous studies have identified two discrete components of physical growth (Marshall [1936], Mullen [1940], McCloy [1940], Barry and Cureton [1961], Burt [1962], Willie [1964], Phillips [1968], and Rarick [1973]. Our findings provide an interesting comparison with those of Rarick in that Rarick reported a dead weight factor similar to our body size. Variables which loaded on our factor of "body structure" were contained in his factor of "strength-power-body size". The failure of body structure to appear as a separate factor in our first and second grade boys is in agreement with Rarick's data, but the present report shows a distinction between the factor structure of physical growth for first and second grade boys and girls whereas the structures of these groups were similar in Rarick's study.

Factor: Hand-Eye Coordination - The variables which loaded on this factor consisted of the various bounce and catch items. Between nine and twelve percent of the variance in each group was accounted for by this factor. The four bounce and catch tests had loadings ranging from .71 to .87 in each of the six groups. The hand-eye coordination factor is similar to the "sensori-motor coordination" reported by Carpenter (1941), and the "gross motor coordination" of Chissom (1971).

Factor: Gross Motor Coordination - This factor was characterized by tests which involved moving the body rapidly while performing a number of fundamental motor skills. From six to ten percent of the variance in all groups was accounted for by this factor. Tests with consistently high loadings included: 10 yard shuttle (.40 to .74), 400 ft. shuttle (.49 to .74), 30 yard dash (.34 to .66). Other variables which appeared frequently but not for all groups were the standing long jump, hopping, cross-over steps, skipping and dynamic balance.

This factor contains items similar to those call "velocity" by Carpenter (1940 and 1941), and "speed" by Ismail and Cowell (1961). In Rarick's study similar items loaded on a factor called "speed and gross body coordination".

Factor: Dynamic Balance - This factor was present in five of the six groups, accounting for six to eight percent of the variance. The only two variables with consistently high loadings on this factor were dynamic balance - number of seconds (.79 to .82) and dynamic balance - quality of performance (.77 to .81).

Balance has been identified as a factor in many studies but only a few investigators have included items which might result in separate categories of static and dynamic balance. Chissom (1971), Ismail (1962), Ismail and Cowell (1961) identified general balance factors for boys. This study indicates that for girls at all three grades and for boys in kindergarten and first grades there are two components of balance. Rarick's study is in partial agreement in that a separate factor of "static balance" was identified for girls.

Factor: Static Balance - This factor was composed primarily of the two rail balance items with factor loadings of from .61 to .88 in all groups. From five to seven percent of the total variance of each group was accounted for by static balance.

TABLE III

BASIC COMPONENTS OF MOTOR PERFORMANCE, SHOWN BY GRADE AND SEX

Kindergarten Boys

Factor		Pct. Var.
1	Body Size	13
2	Hand-Eye Coordination	12
3	Static Balance	7
4	Rating of Aggression	9
5	Gross Motor Coordination	9
6.	Ocular Coordination	7
7	Body Structure	13
8	Social Development	8
9	Dynamic Balance	7
10	Grip Strength	8
11	(Unnamed Factor)	4
	Prop. Total Var.=	98%

Kindergarten Girls

Factor		Pct. Var.
1	Body Size	16
2	Hand-Eye Coordination	11
3	Ocular Coordination	8
4	Grip Strength	7
5	Rating of Aggression	9
6	Gross Motor Coordination	9
7	Social Development	8
8	Body Structure	12
9	Dynamic Balance	6
10	Static Balance	6
	Prop. Total Var.=	92%

First Grade Boys

Factor		Pct. Var.
1	Body Size and Structure	25
2	Hand-Eye Coordination	12
3	Ocular Coordination	7
4	Rating of Aggression	7
5	Social Development	7
6	Dynamic Balance	7
7	Static Balance	6
8	(Unnamed Factor)	7
9	(Unnamed Factor)	6
10	Grip Strength	6
11	Gross Motor Coordination	6
	Prop. Total Var.=	96%

First Grade Girls

Factor		Pct. Var.
1	Body Size	22
2	Rating of Aggression	9
3	Dynamic Balance	8
4	Hand-Eye Coordination	11
5	Social Development	9
6	Static Balance	6
7	Body Structure	8
8	Grip Strength	7
9	Ocular Coordination	6
10	(Unnamed Factor)	4
11	Gross Motor Coordination	6
	Prop. Total Var.=	97%

Second Grade Boys

Factor		Pct. Var.
1	Body Size and Structure	27
2	Gross Motor Coordination	10
3	Social Development	9
4	Hand-Eye Coordination	9
5	Ocular Coordination	6
6	Rating of Aggression	8
7	Static Balance	6
8	(Unnamed Factor)	6
9	Grip Strength	6
	Prop. Total Var.=	88%

Second Grade Girls

Factor		Pct. Var.
1	Body Size	17
2	Gross Motor Coordination	9
3	Social Development	8
4	Body Structure	16
5	Hand-Eye Coordination	10
6	Rating of Aggression	8
7	Grip Strength	7
8	Dynamic Balance	7
9	Ocular Coordination	7
10	Static Balance	5
11	(Unnamed Factor)	4
	Prop. Total Var.=	97%

Factor: Ocular Coordination - This factor was comprised by the three ocular pursuit tasks, which accounted for six to eight percent of the total variance for each group. The factor loadings ranged as follows:

Ocular Pursuits I	.58 to .85
Ocular Pursuits II	.73 to .83
Ocular Pursuits III	.26 to .71

Similar factors have been reported in batteries of perceptual-motor skills by Neeman (1972) and Geddes (1972).

Factor: Grip Strength - This factor was not within the hypothesized structure although it had been identified as a separate factor in the studies of Carpenter (1940 and 1941), Willee (1964) and Phillips (1968). However, grip strength did not emerge as a separate factor in the studies of Burt (1962) and Rarick (1973). The only two variables which loaded on this factor in the present study were measures of right and left grip strength. Loadings ranged from .74 to .92 in all six groups.

Factor: Rating of Aggressive Behavior - This factor consisted of two ratings of behavior as perceived by the teachers. It accounted for seven to nine percent of the total variance and the two variables received loadings from .80 to .90 in all groups. This factor was not included in the hypothesized structure, but it is similar to one identified by Sabatino and Hayden (1970) in which a "teacher descriptive index" was identified.

Factor: Social Development - This factor was hypothesized to include eight items, but in reality only two, the social quotient and the social maturity score (Vineland), had high loadings across the six groups. These two tests had loadings ranging from .81 to .93 and accounted for seven to nine percent of the variance in each group.

Factor: Unnamed - A total of six factors from the 63 which emerged remain unidentified. None of those which remain unnamed accounted for more than seven percent of the variance and none contained high loading for any variable. The grouping of variables on the unnamed factors was such that a descriptive title was not attempted.

Summary

A battery of 51 tests, representing eight hypothesized factors, was administered to approximately 600 children of the Battle Creek, Michigan School System. The sample was randomized to include an equal number of boys and girls from each of the kindergarten, first and second grades. In addition, stratification was employed by geographical area and socioeconomic level within the city.

The data were analyzed separately for the six grade-by-sex groups. Statistical treatment of the data involved factor analysis, utilizing principal components to extract the initial solutions, followed by varimax rotation of factors. A total of ten factors were identified. Of these, eight appeared in all six groups. Two factors, dynamic balance and body structure, appeared in the older girls but not in older boys, indicating that the factor structure is undergoing some modification as motor skill proficiency changes. The findings suggest that a well defined factor structure does exist in young children. However, the scope of the test battery and the limited number of tests within a category do not permit conclusive statements regarding the comprehensive nature of the factor structure to be made at this time.

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APPENDIX A

Note: Only factor loadings greater than .29 are recorded. The number preceding the grade designated indicates the order in which the rotated factor emerged.

Factor: Body Size

1. Kindergarten Girls - 16%

.86 Biceps Girth
.75 Subscapular Skinfold
-.74 Ponderal Index
.74 Weight
.74 Umbilical Skinfold
.67 Triceps Skinfold
.59 Thigh Girth
.47 Calf Girth
-.42 Shap Index
.32 Bi-acromial Diameter

1. First-Grade Girls - 22%

.90 Weight
.81 Triceps Skinfold
.80 Umbilical Skinfold
.78 Thigh Girth
.77 Calf Girth
-.77 Ponderal Index
.74 Subscapular Skinfold
.72 Biceps Girth
.67 Bi-cristal Diameter
.52 Sitting Height
.50 Bi-acromial Diameter
-.42 Shape Index
.30 Standing Height

1. Second-Grade Girls - 17%

-.84 Ponderal Index
.80 Biceps Girth
.77 Triceps Skinfold
.77 Subscapular Skinfold
.71 Calf Girth
.69 Weight
.66 Umbilical Skinfold
.62 Thigh Girth
.36 Bi-cristal Diameter
.30 Bi-acromial Diameter

1. Kindergarten Boys - 13%

.73 Umbilical Skinfold
.72 Triceps Girth
-.65 Ponderal Index
.64 Biceps Girth
.60 Subscapular Skinfold
.56 Weight
.54 Thigh Girth
.53 Calf Girth
-.34 Shape Index

1. First-Grade Boys - 25%

.90 Weight
.88 Thigh Girth
.87 Biceps Girth
.82 Calf Girth
.75 Bi-acromial Diameter
.75 Standing Height
.73 Sitting Height
.73 Bi-cristal Diameter
.72 Umbilical Skinfold
.69 Subscapular Skinfold
.66 Triceps Skinfold
.61 Skeletal Age
.54 Ponderal Index

1. Second-Grade Girls - 27%

.93 Weight
.89 Thigh Girth
.86 Calf Girth
.84 Biceps Girth
.80 Bi-acromial Diameter
.76 Standing Height
.75 Sitting Height
.73 Umbilical Skinfold
.74 Bi-cristal Diameter
.69 Triceps Skinfold
.68 Skeletal Age
.65 Subscapular Skinfold
-.55 Ponderal Index
.31 Left Grip
.31 Right Grip

Factor: Body Structure

8. Kindergarten Girls - 12%

-.89 Standing Height
-.79 Sitting Height
-.63 Bi-acromial Diameter
-.58 Weight
-.53 Skeletal Age
-.43 Bi-cristal Diameter
-.37 Ponderal Index

7. Kindergarten Boys - 13%

-.86 Standing Height
-.73 Sitting Height
-.71 Weight
-.67 Bi-acromial Diameter
-.57 Bi-cristal Diameter
-.47 Skeletal Age
-.47 Thigh Girth
-.46 Biceps Girth
-.42 Calf Girth

7. First-Grade Girls - 8%

.76 Standing Height
.58 Sitting Height
.56 Skeletal Age
.46 Bi-acromial Diameter
.37 Cronological Age
.35 Ponderal Index
.32 Bi-cristal Diameter
.31 Standing Broad Jump

First-Grade Boys

(not identified: see loading under Body Size)

4. Second-Grade Girls 16%

.91 Standing Height
.80 Skeletal Age
.75 Sitting Height
.75 Bi-acromial Diameter
.66 Bi-cristal Diameter
.65 Weight
.51 Calf Girth
.50 Thigh Girth
.40 Biceps Girth
.30 Right Grip Strength

Second-Grade Boys

(not identified: see loading under Body Size)

Factor: Hand-Eye Coordination

2. Kindergarten Girls - 11%

.80 Bounce and Catch - Left, Qual.
.79 Bounce and Catch - Right, Qual.
.79 Bounce and Catch - Left, Num.
.71 Bounce and Catch - Right, Num.
-.51 Reaction Time
.32 Standing Broad Jump

2. Kindergarten Boys - 12%

-.81 Bounce and Catch - Right, Num.
-.80 Bounce and Catch - Right, Qual.
-.79 Bounce and Catch - Left, Qual.
-.79 Bounce and Catch - Left, Num.
-.40 Skipping

4. First-Grade Girls - 11%

.87 Bounce and Catch - Right, Num.
.82 Bounce and Catch - Right, Qual.
.80 Bounce and Catch - Left, Num.
.75 Bounce and Catch - Left, Qual.

2. First-Grade Boys - 12%

.81 Bounce and Catch - Left, Num.
.79 Bounce and Catch - Left, Qual.
.77 Bounce and Catch - Right, Num.
.73 Bounce and Catch - Right, Qual.
.33 Chronological Age
-.32 Teacher Rating - Anxiety
-.31 Reaction Time
.30 Sitting Height

5. Second-Grade Girls - 10%

-.81 Bounce and Catch - Right, Num.
-.80 Bounce and Catch - Left, Num.
-.77 Bounce and Catch - Left, Qual.
-.74 Bounce and Catch - Right, Qual.

4. Second-Grade Boys - 9%

.82 Bounce and Catch - Left, Num.
.78 Bounce and Catch - Right, Num.
.77 Bounce and Catch - Right, Qual.
.76 Bounce and Catch - Left, Qual.
.35 Jumping Jacks

Factor: Gross Motor Coordination

6. Kindergarten Girls - 9%

.74 400-ft. Shuttle Run
.69 10-yd. Shuttle Run
-.59 Hop-Right
-.55 Hop-Left
.52 30-yd. Dash
-.40 Standing Broad Jump

11. First-Grade Girls - 6%

.60 Hop-Left
-.51 400-ft. Shuttle Run
-.50 30-yd. Dash
-.48 10-yd. Shuttle Run
.43 Skipping

2. Second-Grade Girls - 9%

-.72 10-yd. Shuttle Run
-.70 400-ft. Shuttle Run
-.66 30-yd. Dash
.51 Standing Broad Jump
.36 Sit and Reach
-.36 Ocular Pursuits III

5. Kindergarten Boys - 9%

-.74 10-yd. Shuttle Run
-.59 30-yd. Dash
.59 Standing Broad Jump
-.56 400-ft. Shuttle Run
.36 Hop-Right
.34 Hop-Left
.30 General Anxiety Scale

11. First-Grade Boys - 6%

-.49 400-ft. Shuttle Run
.46 Cross-over Steps
-.40 10-yd. Shuttle Run
.39 Hop-Left
-.35 Subscapular Skinfold
-.34 30-yd. Dash
-.34 Umbilical Skinfold

2. Second-Grade Boys - 10%

-.64 30-yd. Dash
-.63 10-yd. Shuttle Run
.58 Standing Broad Jump
-.49 400-ft. Shuttle Run
-.46 Subscapular Skinfold
-.42 Umbilical Skinfold
-.41 Crorological Age
.40 Dynamic Balance - Num.
.40 Skeletal Age
.40 Dynamic Balance - Qual.
-.39 Triceps Skinfold
.31 Ponderal Index

Factor: Dynamic Balance

9. Kindergarten Girls - 6%

.80 Dynamic Balance - Num.
.78 Dynamic Balance - Qual.

3. First-Grade Girls - 8%

.79 Dynamic Balance - Num.
.78 Dynamic Balance - Qual.
-.42 400-ft. Shuttle Run
-.42 10-yd. Shuttle Run
.34 Shape Index
.32 Cross-over Steps

8. Second-Grade Girls - 7%

-.79 Dynamic Balance - Qual.
-.79 Dynamic Balance - Num.
-.38 Cross-over Steps
-.37 Hop-Left

9. Kindergarten Boys - 7%

-.82 Dynamic Balance - Num.
-.81 Dynamic Balance - Qual.
.40 Reaction Time

6. First-Grade Boys - 7%

.79 Dynamic Balance - Num.
.77 Dynamic Balance - Qual.

Second-Grade Boys

(not identified: see Gross Motor Coordination)

Factor: Static Balance

10. Kindergarten Girls - 6%

.63 Rail Balance - Right
.61 Rail Balance - Left
.33 General Anxiety Scale
-.30 Pulse Rate Recovery
-.30 Visual Retention

6. First-Grade Girls - 6%

.88 Rail Balance - Left
.86 Rail Balance - Right

10. Second-Grade Girls - 5%

-.70 Rail Balance - Right
-.61 Rail Balance - Left
-.30 Self Concept

3. Kindergarten Boys - 7%

-.86 Rail Balance - Right
-.85 Rail Balance - Left

7. First-Grade Boys - 6%

.70 Rail Balance - Left
.64 Rail Balance - Right
.45 Standing Broad Jump
-.40 10-yd. Shuttle Run
.34 Jumping Jacks

7. Second-Grade Boys - 6%

.75 Rail Balance - Right
.75 Rail Balance - Left
.31 Palmar Sweat

Factor: Ocular Coordination

3. Kindergarten Girls - 8%

-.73 Ocular Pursuits II
-.70 Ocular Pursuits I
-.63 Ocular Pursuits III
.53 Self Concept
.32 Visual Retention

9. First-Grade Girls - 6%

.77 Ocular Pursuits II
.66 Ocular Pursuits I
.51 Ocular Pursuits III
-.30 Cross-over Steps

9. Second-Grade Girls - 7%

.82 Ocular Pursuits II
.78 Ocular Pursuits I
.45 Ocular Pursuits III

6. Kindergarten Boys - 7%

.79 Ocular Bursuits I
.78 Ocular Pursuits II
.51 Reaction Time
-.32 Cross-over Steps

3. First-Grade Boys - 7%

-.76 Ocular Pursuits II
-.71 Ocular Pursuits III
-.58 Ocular Pursuits I
.45 Self Concept
.37 Angels in the Snow

5. Second-Grade Boys - 6%

.85 Ocular Pursuits I
.83 Ocular Pursuits II

Factor: Grip Strength

4. Kindergarten Girls - 7%

.88 Left Grip Strength
.86 Right Grip Strength

8. First-Grade Girls - 7%

.92 Left Grip Strength
.90 Right Grip Strength

7. Second-Grade Girls - 7%

-.87 Left Grip Strength
-.83 Right Grip Strength

10. Kindergarten Boys - 8%

.88 Right Grip Strength
.88 Left Grip Strength
-.32 General Anxiety Scale

10. First-Grade Boys - 6%

.75 Right Grip Strength
.74 Left Grip Strength

9. Second-Grade Boys - 6%

.80 Right Grip Strength
.79 Left Grip Strength
.36 Dynamic Balance - Num.

Factor: Rating of Aggression

5. Kindergarten Girls - 9%

.83 Teacher Rating - Phys. Agg.
.80 Teacher Rating - Verbal Agg.
-.53 Angels in the Snow
-.47 Cross-over Steps
-.37 Draw a Man
-.33 Visual Retention
-.31 Palmar Sweat

2. First-Grade Girls - 9%

.88 Teacher Rating - Phys. Agg.
.87 Teacher Rating - Verbal Agg.
-.47 30-yd. Dash
.38 Standing Broad Jump

6. Second-Grade Girls - 8%

-.90 Teacher Rating - Phys. Agg.
-.88 Teacher Rating - Verbal Agg.
.31 Jumping Jacks
.31 Palmar Sweat

4. Kindergarten Boys - 9%

-.90 Teacher Rating - Verbal Agg.
-.89 Teacher Rating - Phys. Agg.
.49 Visual Retention
.32 Self Concept
.31 Draw a Man

4. First-Grade Boys - 7%

-.88 Teacher Rating - Verbal Agg.
-.87 Teacher Rating - Phys. Agg.
.31 General Anxiety Scale

6. Second-Grade Boys - 8%

.89 Teacher Rating - Phys. Agg.
.88 Teacher Rating - Verbal Agg.
-.33 Pulse-Rate Recovery

Factor: Social Development

7. Kindergarten Girls - 8%

-.93 Sociability Quotient
-.92 Social Maturity (Vineland)
-.34 Self Concept

5. First-Grade Girls - 9%

.93 Sociability Quotient
.89 Social Maturity (Vineland)
.42 Draw a Man
.31 Skipping
.30 Visual Retention

3. Second-Grade Girls - 8%

.89 Sociability Quotient
.86 Social Maturity (Vineland)
.33 Visual Retention

8. Kindergarten Boys - 8%

-.92 Social Maturity (Vineland)
-.91 Sociability Quotient
-.35 Angels in the Snow
.30 Teacher Rating - Anxiety

5. First-Grade Boys - 7%

-.92 Sociability Quotient
-.85 Social Maturity (Vineland)

3. Second-Grade Boys - 9%

.83 Social Maturity (Vineland)
.81 Sociability Quotient
.50 Angels in the Snow
-.48 Reaction Time
.41 Visual Retention
-.34 Dynamic Balance - Num.
.33 Jumping Jacks
-.30 Dynamic Balance - Qual.